

**REMARKS**

**Status of the Claims:**

Claims 1 – 3, 5 – 10 and 76 – 80 are pending.

Claims 4 and 11 – 75 are cancelled.

Claims 1 – 3, 5, 6 and 76 are currently amended.

**Amendments to the Claims:**

No new matter has been introduced by way of the claim amendments.

Claim 1 is presently amended to include the limitation of claim 4, namely that the carbon nanotubes have diameters of less than about 3 nm. Claim 1 is also presently amended to recite that the carbon nanotubes are dispersed in the solvent. Support for this amendment may be found in at least paragraphs [0009], [0040], [0048] and [0069] of the instant specification. Further, claim 1 is presently amended to recite that the fluorescent ink is suitable for deposition on a surface. Support for this amendment may be found in at least paragraphs [0054], [0055] and [0057] of the instant specification. Further support for this amendment is established by Figure 3 of the instant specification. The phrases 'wherein the fluorescent ink is deposited on a surface' and 'wherein the solvent is evaporated from the surface' have been deleted from the claim. The order of the elements 'a solvent' and 'carbon nanotubes' have been reversed to improve clarity and readability of the claim. The claim is also amended to clarify that the carbon nanotubes are suspended in the solvent.

Claims 2, 3, 5 and 6 are presently amended for purposes of antecedent support.

Claim 76 is presently amended to recite that the fluorescent ink is suitable for deposition on a surface in patterned form. Support for this amendment may be found in at least paragraph [0055] of the instant specification. Further support for this amendment is established by Figure 3 of the instant specification.

**I. Priority Claim Under 35 U.S.C. § 119(e)**

The Examiner has acknowledged Applicants' claim for priority benefit of earlier-filed United States provisional patent application 60/500,394 under 35 U.S.C. § 119(e). However, the Examiner asserts that Applicants have not complied with one or more conditions to receive the benefit of an earlier filing date under 35 U.S.C. § 119(e). Office Action page 2.

The Examiner asserts that United States provisional patent application 60/500,394 provides adequate support for the subject matter of claims 3, 5, 6, 10 and 76; the embodiments of claims 1 and 2, wherein the carbon nanotubes are single-walled; the embodiments of claim 7, wherein the liquid medium is water, organic solvents and combinations thereof; and the embodiment of claim 8, wherein the liquid medium is water. The Examiner has stated that this group of subject matter has an effective filing date of September 5, 2003.

The Examiner has stated that claims 4, 9 and 77 – 80 and other embodiments of claims 1, 2, 7 and 8 have an effective filing date of September 2, 2004.

Applicants acknowledge Examiner's characterization of the effective filing date.

**II. Claims Rejected Under 35 U.S.C. § 112, Second Paragraph**

Claims 1 and 76 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Office Action page 3.

The Examiner asserts that claim 1 is indefinite because it is not clear whether the ink or the dried deposited mark is being claimed. The Examiner asserts that claim 76, which is dependent from claim 1, is further indefinite since it recites that the ink is deposited in patterned form. The Examiner states that since the originally examined claims were directed to an ink, the features of these claims directed to use of the ink have been given no weight in further examination.

Applicants have amended claim 1 to delete the phrases 'wherein the fluorescent ink is deposited on a surface' and 'wherein the solvent is evaporated from the surface' in order to clarify

that it is the ink that is claimed. Furthermore, Applicants have added a new limitation to claim 1 that the 'fluorescent ink is suitable for deposition on a surface'. Applicants respectfully assert that this phrase describes a feature of the fluorescent ink itself and not its intended use. It is necessary that an ink composition be suitable for deposition on a surface; otherwise, the composition would not function as an ink. Applicants respectfully assert that the feature of being 'suitable for deposition on a surface' would be readily understood by one of ordinary skill in the art. Hence, Applicants respectfully assert that claim 1, as amended, is not indefinite under 35 U.S.C. § 112, second paragraph. In view of the amendments to claim 1, Applicants respectfully request that the 35 U.S.C. § 112, second paragraph, rejection of claim 1 be withdrawn.

Claim 76 depends from claim 1. Applicants have amended claim 76 to recite that the fluorescent ink is suitable for deposition on a surface in patterned form. As amended, claim 76 recites a further limitation of a fluorescent ink described in claim 1, which is suitable for deposition on a surface. Hence, Applicants respectfully assert that claim 76, as amended, is not indefinite under 35 U.S.C. § 112, second paragraph. In view of the amendments to claim 76, Applicants respectfully request that the 35 U.S.C. § 112, second paragraph, rejection of claim 76 be withdrawn.

### **III. Claims Rejected Under 35 U.S.C. § 102**

The standard of review for establishing anticipation under 35 U.S.C. § 102 is set forth as follows: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987); MPEP § 2131.

#### ***III.1 Rejection of Claims 1 and 76 Under 35 U.S.C. § 102(a or b) as Anticipated by JP 2003-026981***

Claims 1 and 76 stand rejected under 35 U.S.C. § 102(a or b) as anticipated by JP 2003-026981 (hereinafter, *JP981*). Office Action page 3. Applicants respectfully traverse the rejection of these claims.

The Examiner asserts that *JP981* teaches an ink deposited on paper and formulated for adhesion on paper, comprising a dispersion of carbon nanotubes. The Examiner asserts that the carbon nanotubes are inherently fluorescent and emit a wavelength when irradiated with visible light. The Examiner asserts that *JP981* teaches the claimed ink.

*JP981* teaches water-in-oil or oil-in-water emulsions of carbon nanotubes formulated as an ink for use in mimeograph printing. Applicants argued in the response of record filed December 8, 2008 that the ink of *JP981* was not inherently fluorescent, since fluorescence of carbon nanotubes depends on dispersion, diameter and chirality. The Examiner acknowledges Applicants' previous argument but states that no evidence has been provided to support this assertion or to support that the carbon nanotubes of *JP981* are not inherently fluorescent.

Applicants have amended claim 1 to include the limitation that the carbon nanotubes have diameters of less than about 3 nm. *JP981* does not teach this limitation, either expressly or inherently. Hence, Applicants' claim 1 is not anticipated by *JP981*. Claim 76 depends directly from allowable claim 1 and is therefore patentable for at least the same reasons. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988).

*III.2 Rejection of Claims 1 and 76 Under 35 U.S.C. § 102(b) as Anticipated by United States Patent 6,330,939*

Claims 1 and 76 stand rejected under 35 U.S.C. § 102(b) as anticipated by United States Patent 6,330,939 (hereinafter, *US939*). Office Action page 4. Applicants respectfully traverse the rejection of these claims.

The Examiner asserts that *US939* teaches an ink, which is printed on a substrate, and formulated for adhesion to a substrate, comprising a dispersion of carbon nanotubes. The Examiner asserts that the carbon nanotubes are inherently fluorescent and emit a wavelength when irradiated with visible light. The Examiner asserts that *US939* teaches the claimed ink.

*US939* teaches "smart inks" comprising carbon nanotubes, which are applied to currency as a security feature. The inks utilize the electrical and magnetic properties of the carbon nanotubes to provide regions of enhanced electrical permittivity. Applicants argued in the response of record filed December 8, 2008 that the inks of *US939* were not inherently

fluorescent, since fluorescence of carbon nanotubes depends on dispersion, diameter and chirality. The Examiner acknowledges Applicants' previous argument but states that no evidence has been provided to support this assertion or to support that the carbon nanotubes of *US939* are not inherently fluorescent.

Applicants have amended claim 1 to include the limitation that the carbon nanotubes have diameters of less than about 3 nm. Applicants have also amended claim 1 to include the limitation that the carbon nanotubes are dispersed in the solvent. *US939* does not teach either of these limitations, either expressly or inherently. Hence, Applicants' claim 1 is not anticipated by *US939*. Claim 76 depends directly from allowable claim 1 and is therefore patentable for at least the same reasons.

*III.3 Rejection of Claims 1 and 76 Under 35 U.S.C. § 102(b) as Anticipated by United States Patent Application Publication 2002/0025490*

Claims 1 and 76 stand rejected under 35 U.S.C. § 102(b) as anticipated by United States Patent Application Publication 2002/0025490 (hereinafter, *US490*). Office Action page 5. Applicants respectfully traverse the rejection of these claims.

The Examiner asserts that *US490* teaches an ink comprising a dispersion of carbon nanotubes, which are inherently fluorescent and emit a wavelength when irradiated with visible light. The Examiner asserts that the ink is printed on a substrate and formulated for adhesion to a substrate. The Examiner asserts that ink can be invisible. The Examiner asserts that *US490* teaches the claimed ink.

*US490* teaches liquid or powder inks comprising carbon nanotubes. The inks are applied to articles, and the Raman spectra of the carbon nanotubes are detected. Applicants argued in the response of record filed December 8, 2008 that the inks of *US490* were not inherently fluorescent, since fluorescence of carbon nanotubes depends on dispersion, diameter and chirality. The Examiner acknowledges Applicants' previous argument but states that no evidence has been provided to support this assertion or to support that the carbon nanotubes of *US939* are not inherently fluorescent.

Applicants have amended claim 1 to include the limitation that the carbon nanotubes have diameters less than about 3 nm. *US490* does not teach this limitation, either expressly or inherently. Hence, Applicants' claim 1 is not anticipated by *US490*. Claim 76 depends directly from allowable claim 1 and is therefore patentable for at least the same reasons.

*III.4 Rejection of Claims 1 – 3, 7 – 10, 76, 78 and 79 Under 35 U.S.C. § 102(e) as Anticipated by United States Patent 7,097,788*

Claims 1 – 3, 7 – 10, 76, 78 and 79 stand rejected under 35 U.S.C. § 102(e) as anticipated by United States Patent 7,097,788 (hereinafter, *US788*). Office Action page 5. Applicants respectfully traverse the rejection of these claims.

The Examiner asserts that *US788* teaches an ink that is printed on a substrate and formulated for adhesion to a substrate, comprising a dispersion of carbon nanotubes in a binder and solvent. The Examiner asserts that the ink can also contain surfactants, dyes and single-wall, double-wall, or multi-wall carbon nanotubes, all of which are chemically derived. The Examiner asserts that the nanotubes are inherently fluorescent and emit near IR wavelengths when irradiated with visible light. The Examiner asserts that the solvent can be water, organic solvents and mixtures thereof. The Examiner asserts that *US788* teaches the claimed ink

*US788* teaches applying a carbon nanotube ink to a substrate and then orienting the carbon nanotubes in the applied ink to increase electrical conductivity. Applicants argued in the response of record filed December 8, 2008 that the inks of *US788* were not inherently fluorescent, since fluorescence of carbon nanotubes depends on dispersion, diameter and chirality. The Examiner acknowledges Applicants' previous argument but states that no evidence has been provided to support this assertion or to support that the carbon nanotubes of *US788* are not inherently fluorescent.

Applicants have amended claim 1 to include the limitation that the carbon nanotubes have diameters of less than about 3 nm. Applicants have also amended claim 1 to include the limitation that the carbon nanotubes are dispersed in the solvent. *US788* does not teach either of these limitations, either expressly or inherently. Hence, Applicants' claim 1 is not anticipated by *US788*. Claims 2, 3, 7 – 10, 76, 78 and 79 depend either directly or indirectly from allowable claim 1 and are patentable for at least the same reasons.

*III.5 Summary of the 35 U.S.C. § 102 Rejections*

In summary, Applicants' claim 1, as amended, is not anticipated by any of the references cited in the instant Office Action, at least because none of the references teach each and every element set forth in claim 1. Further, claims 2, 3, 5 – 10 and 76 – 80 depend either directly or indirectly from allowable claim 1 and are patentable for at least the same reasons. Therefore, Applicants respectfully request that the Examiner's claim rejections made under 35 U.S.C. § 102 be withdrawn.

**IV. Claims Rejected Under 35 U.S.C. § 103(a)**

Claims 1 – 10 and 76 – 80 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *US490* in combination with *O'Connell, et al.*, "Band Gap Fluorescence from Individual Single-Walled Carbon Nanotubes", *Science*, 297:2002, pp. 593 – 596 (hereinafter, *O'Connell*). Office Action page 6. Applicants respectfully traverse the rejection of these claims.

The standard of review for establishing obviousness under 35 U.S.C. § 103(a) is set forth as follows: For rejections made under 35 U.S.C. § 103(a), all claim limitations must be taught or suggested by the prior art to establish obviousness. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974). Furthermore, "[r]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness". *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007) (citing with approval *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). In addition, in issuing rejections under 35 U.S.C. § 103(a), the Examiner must consider an invention and the prior art as a whole in accordance with the requisite *Graham* factual inquiries. M.P.E.P. § 2141; *Ruiz v. A.B. Chance Co.* 69 U.S.P.Q.2d 1686, 1690 (Fed. Cir. 2004).

Further, the standard of review for establishing a motivation to combine references for an obviousness rejection is set forth as follows: "Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so." *In re Kahn*, 441 F.3d 977, 986, 78 USPQ2d 1329, 1335 (Fed. Cir. 2006). However, "[i]f proposed modification would render the prior art

invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

The Examiner asserts that *US490* teaches the claimed ink, as discussed hereinabove. The Examiner asserts that the examples of *US490* teach compositions of the inks in which the carbon nanotubes are dispersed. The Examiner asserts that *US490* teaches a liquid medium, a polymeric binder, and optional surfactants or dyes. The Examiner asserts that *US490* teaches that the carbon nanotubes are Raman-active [sic]. The Examiner asserts that *O'Connell* teaches that SWNTs with a diameter of 0.7 – 1.1 nm are Raman-active. The Examiner asserts that the nanotubes of *O'Connell* are a separated homogenous population which is chemically derived. Further, the Examiner asserts that *O'Connell* teaches that all of the nanotubes are semiconductive, which means homogenized by electronic form. Given the above, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to use SWNTs having a diameter of 0.7 – 1.1 nm as the carbon nanotubes in the ink of *US490*. Hence, the Examiner asserts that the references suggest the claimed ink.

Applicants respectfully submit that *US490* expressly teaches that the carbon nanotube Raman-active inks are essentially or actually devoid of autofluorescence or other interfering backgrounds. Support for such teachings can be found in at least paragraphs [0061], [0105] and [0122] of *US490*. In addition, *US490* teaches that the autofluorescence is an interfering background for the Raman spectra (*Ibid*).

Applicants comments regarding *O'Connell* follow. *O'Connell* teaches that carbon nanotube fluorescence is quenched by the aggregation of carbon nanotubes into bundles (see p. 593, Abstract). Specifically, *O'Connell* teaches that fluorescence quenching is due to interaction of metallic carbon nanotubes with semiconducting carbon nanotubes in the bundles (see p. 593, Abstract and p. 595, Col. 3, lines 13 – 22). *O'Connell* also teaches that carbon nanotubes can be dispersed by sonication of a surfactant solution (see p. 594, Col. 2, lines 6 – 14) and in some embodiments by further wrapping the carbon nanotubes in a polymer (see p. 594, Col. 2, lines 21 – 26).



In light of the aforementioned teachings, Applicants respectfully traverse the Examiner's assertion that *US490* and *O'Connell* suggest the claimed ink. As discussed hereinabove, *US490* expressly teaches that the carbon nanotubes are devoid of autofluorescence. Furthermore, *US490* expressly teaches that autofluorescence is an interfering background for Raman spectroscopy that is to be avoided. However, the combination of *O'Connell* with *US490* would form an ink that is fluorescent in addition to being Raman-active. Hence, the combination of *O'Connell* with *US490* would render *US490* unsatisfactory for its intended purpose, and there is accordingly no motivation to combine the references to lead to the claimed ink.

In addition, Applicants respectfully traverse the Examiner's assertion that *O'Connell* teaches a nanotube population that is a separated homogenous population in which all of the nanotubes are semiconductive (i.e., homogenized by electronic form). Specifically, *O'Connell* teaches that metallic carbon nanotubes quench the fluorescence of semiconducting carbon nanotubes when associated in bundles, which implies that the carbon nanotubes in *O'Connell* are not homogenized by electronic form.

In view of the foregoing remarks and amendments, Applicants respectfully assert that claim 1 is not obvious in view of the cited references. Claims 2, 3, 5 - 10 and 76 - 80 depend either directly or indirectly from allowable claim 1 and are patentable for at least the same reasons. Therefore, Applicants respectfully request that the Examiner's claim rejections made under 35 U.S.C. § 103(a) be withdrawn.

### CONCLUSIONS

Claims 1 - 3, 5 - 10 and 76 - 80 remain pending in the Application. Applicants respectfully assert that claims 1 - 3, 5 - 10 and 76 - 80, as these claims presently stand amended, are in a condition for allowance based on the remarks presented hereinabove.

If any fees are due and are not included, the Director is hereby authorized to charge any fees or credit any overpayment to Deposit Account Number 23-2426 of Winstead PC (referencing matter 11321-P075WOUS).

If the Examiner has any questions or comments concerning this paper or the present application in general, the Examiner is invited to call the undersigned at 713-650-2764.

Respectfully submitted,

WINSTEAD PC

Attorney/Agent for Applicants

Date: April 9, 2009

By: /Robert C. Shaddox/  
Robert C. Shaddox, Reg. No. 34,011  
Farhang Amini, Ph.D., Reg. No. 59,412

P. O. Box 50784  
Dallas, Texas 75201

Tel: 713.650.2764  
Fax: 214.745.5390